

February 14, 2002

Dr. Stephan Brocoum, Assistant Manager  
Office of Licensing and Regulatory Compliance  
U.S. Department of Energy  
Yucca Mountain Site Characterization Office  
P.O. Box 364629  
North Las Vegas, NV 89036-8629

SUBJECT: EVOLUTION OF THE NEAR-FIELD ENVIRONMENT KEY TECHNICAL ISSUE  
AGREEMENTS

Dear Dr. Brocoum:

During a Technical Exchange and Management Meeting held on January 9-12, 2001, the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) reached agreement on issues pertaining to the Evolution of the Near-Field Environment (ENFE) Key Technical Issue (KTI). By letters dated February 2, March 2, March 22, March 30, April 13, April 30, and September 28, 2001, DOE provided documents pertaining to NRC/DOE agreements, including a number of documents pertaining to ENFE agreements. The NRC staff has reviewed these documents as they relate to the ENFE KTI and the results of the staff's review are enclosed.

After you have reviewed this letter, please contact Mr. James Andersen of my staff to discuss these issues further. He can be reached at (301) 415-5717.

Sincerely,

/RA/

Janet Schlueter, Chief  
High-Level Waste Branch  
Division of Waste Management  
Office of Nuclear Material Safety  
and Safeguards

Enclosure: As stated  
cc: See attached distribution list

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the Owens Valley  
R. Quintero, Inter-Tribal Council of Nevada  
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M. Bengochia, Bishop Paiute Indian Tribe  
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L. Tom, Paiute Indian Tribes of Utah  
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J. Leeds, Las Vegas Indian Center  
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**NRC Review of DOE Documents Pertaining to  
Evolution of the Near-Field Environment Key Technical Issue Agreements**

The U.S. Nuclear Regulatory Commission (NRC) goal of issue resolution during this interim pre-licensing period is to assure that the U.S. Department of Energy (DOE) has assembled enough information on a given issue for NRC to accept a license application for review. Resolution by the NRC staff during pre-licensing does not prevent anyone from raising any issue for NRC consideration during the licensing proceedings. Also, and just as importantly, resolution by the NRC staff during pre-licensing does not prejudge what the NRC staff evaluation of that issue will be after it's licensing review. Issues are resolved by the NRC staff during pre-licensing when the staff has no further questions or comments about how DOE is addressing an issue. Pertinent new information could raise new questions or comments on a previously resolved issue.

This enclosure addresses several NRC/DOE agreements made during the Evolution of the Near-Field Environment (ENFE) Technical Exchange and Management Meeting on January 9-12, 2001, (see NRC letter dated January 26, 2001, which summarized the meeting). By letters dated February 2, March 2, March 22, March 30, April 13, April 30, and September 28, 2001, DOE submitted a number of documents to address some of the ENFE agreements. The documents submitted and associated KTI agreements are discussed below:

**1) Evolution of the Near-Field Environment Agreement 1.01**  
**Evolution of the Near-Field Environment Agreement 2.01**  
**Evolution of the Near-Field Environment Agreement 4.07**

Wording of the Agreement: Provide updated FEPs AMRs with additional technical bases for those FEPs previously identified by the NRC in Rev. 03 of the ENFE IRSR as inadequately screened. In Rev 03 of the ENFE IRSR, the NRC identified 17 FEPs associated with Subissue 1 for which no screening arguments were identified in the FEPs data base, screening arguments were inconsistent with other project documents, or inadequate exclusion arguments were provided. The lack of screening arguments has been addressed in Rev 00 of the FEPs data base and Rev 00 of the supporting AMRs. Current revisions (or ICNs) of the FEPs AMRs, scheduled for completion in January 2001, will partially address the remaining NRC comments. Consideration of the remaining NRC comments will be provided in subsequent FEPs AMR revisions, expected to be available as periodic revisions, the entirety of which will be available prior to license application.

NRC Review: DOE provided, and NRC reviewed the following documents as they pertain to this agreement:

- 1) FEPs: Disruptive Events (ANL-WIS-MD-000005, Rev 00, ICN 01)
- 2) Clad Degradation - FEPs Screening Arguments (ANL-WIS-MD-000008, Rev 00, ICN 01)
- 3) Waste Form Colloid Associated Concentration Limits: Abstraction and Summary (ANL-WIS-MD-000012, Rev 00, ICN 01)
- 4) FEPs: System Level and Criticality (ANL-WIS-MD-000017, Rev 00, INC 00)
- 5) FEPs: Screening of Processes and Issues in Drip Shield and Waste Package Degradation (ANL-EBS-PA-000002, Rev 01, ICN 00)
- 6) FEPs: Evaluation of Applicability of Biosphere-Related FEPs (ANL-MGR-MD-000011, Rev 01, ICN 00)

Enclosure

- 7) FEPs: Saturated Zone Flow and Transport (ANL-NBS-MD-000002, Rev 01, ICN 00)
- 8) FEPs: Thermal Hydrology and Coupled Processes (ANL-NBS-MD-000004, Rev 00, ICN 01)
- 9) FEPs: Miscellaneous Waste Form (ANL-WIS-MD-000009, Rev 00, ICN 01)
- 10) Engineered Barrier System FEPs (ANL-WIS-PA-000002, Rev 01)
- 11) FEPs: Unsaturated Zone Flow and Transport (ANL-NBS-MD-000001, Rev 01)

These FEPs documents were discussed during the two Total System Performance Assessment and Integration (TSPAI) technical exchanges held in May and August 2001. During these technical exchanges, the NRC and DOE reached a number of separate agreements pertaining to FEPs (see TSPAI Agreements 2.01 to 2.04). With these specific TSPAI agreements in place, this agreement is complete.

Additional Information Needed: Resolution of the ENFE subissues depend on the satisfactory resolution of the ENFE portion of TSPAI Agreements 2.01 through 2.04.

Status of Agreement: ENFE Agreements 1.01, 2.01, and 4.07 are "Complete."

## **2) Evolution of the Near-Field Environment Agreement 1.02**

### **Evolution of the Near-Field Environment Agreement 2.02**

### **Evolution of the Near-Field Environment Agreement 4.08**

Wording of the Agreement: Provide the FEPs database. The DOE will provide the FEPs data base to the NRC during March 2001.

NRC Review: The NRC reviewed the FEPs database as it pertains to this agreement. The FEPs database was discussed during the two TSPAI technical exchanges held in May and August 2001. During these technical exchanges, the NRC and DOE reached a number of separate agreements pertaining to FEPs (see TSPAI Agreements 2.01 to 2.04). With these specific TSPAI agreements in place, this agreement is complete.

Additional Information Needed: Resolution of the ENFE subissues depends on the satisfactory resolution of the ENFE portion of TSPAI Agreements 2.01 through 2.04.

Status of Agreement: ENFE Agreements 1.02, 2.02, and 4.08 are "Complete."

## **3) Evolution of the Near-Field Environment Agreement 1.03**

Wording of the Agreement: Provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR, Rev. 01 and 02, including (1) information on the quantity of unreacted solute mass that is trapped in dry-out zone in TOUGHREACT simulations, as well as how this would affect precipitation and the resulting change in hydrologic properties and (2) documentation of model validation consistent with the DOE QA requirements. The DOE will provide documentation of model validation, consistent with the DOE QA requirements, in the *Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR* (MDL-NBS-HS-000001) Rev 01, expected to be available to the NRC in March 2001. The DOE will provide information on the quantity of unreacted solute mass that is trapped in the dryout zone in TOUGHREACT simulations in the *Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR* Rev 02, expected to be available to the NRC in FY 02.

NRC Review: The NRC reviewed Drift-Scale Coupled Processes (DST and THC Seepage) Models (MDL-NBS-HS-000001, Rev 01, ICN 00) as it pertains to this agreement and it only partially satisfies the agreement. According to information received at the ENFE Technical Exchange (presentation by Sonnenthal and Apps, January 2001) this revision of the document was to contain the technical basis for neglecting coupled thermal-hydrological-chemical (THC) alterations of the Calico Hills nonwelded (CHn) hydrogeological units. Specifically, NRC was told MDL-NBS-HS-000001, Rev. 01, was to contain simulation results demonstrating that "resulting porosity, permeability, and mineralogical changes in the CHn are expected to be inconsequential." Staff understands that the THC modeling described in MDL-NBS-HS-000001, Rev. 01, does include the CHn hydrogeological units, but simulation results specifically related to alteration of the CHn hydrogeological units are not presented in MDL-NBS-HS-000001, Rev. 01.

Additional Information Needed: In the next revision of the document, provide the information discussed above, as well as the information discussed in the second half of the agreement.

Status of Agreement: Since DOE still needs to submit Rev. 02 of the document, ENFE Agreement 1.03 will continue to be listed as "Partly Received."

#### **4) Evolution of the Near-Field Environment Agreement 1.07**

Wording of the Agreement: Provide physical evidence that supports the model of matrix fracture interaction precipitation effects (e.g., coring). The DOE will provide the following evidence that supports the model of matrix/fracture interaction precipitation effects: (1) Existing data from the Single Heater Test (SHT) of post-test overcoring Mineralogy-Petrology (Min-Pet) analysis (SHT final report [MOL.20000103.0634] and DTN LASL831151.AQ98.001) is expected to be provided to the NRC in March 2001. (2) Results of ongoing side-wall sampling Min-Pet analyses of DST samples are expected to be provided to the NRC in FY 02. (3) The DOE expects to provide the *Drift-Scale Coupled Processes (DST and THC Seepage) Models* AMR (MDL-NBS-HS-000001) Rev 01 to the NRC as evidence of matrix-fracture interaction in March 2001.

NRC Review: The NRC reviewed Drift-Scale Coupled Process (DST and THC Seepage) Models (MDL-NBS-HS-000001, Rev 01, ICN 00), the Single Heater Test - Final Report (BAB000000-01717-5700-00005, Rev 00, ICN 01), and Data to Support the Matrix/Fracture Model (LA0009SL831151.001/2) as they pertain to this agreement. The NRC staff has no comments at this time. The NRC staff will review the other document pertaining to this agreement when it becomes available.

Additional Information Needed: None at this time.

Status of Agreement: Since DOE agreed to provide the results of ongoing side-wall sampling Min-Pet analyses of DST samples in FY 02, ENFE Agreement 1.07 will continue to be listed as "Partly Received."

#### **5) Evolution of the Near-Field Environment Agreement 2.09**

Wording of the Agreement: Provide the In-Drift Precipitates/Salts Analysis AMR, Rev. 00, ICN 02, including (1) the major anionic (e.g., fluoride or chloride) and cationic species, and (2) additional technical basis for the low relative humidity model. The DOE will provide the *In-Drift*

*Precipitates/Salts Analysis* AMR (ANL-EBS-MD-000045), Rev. 00, ICN 02, including the major anionic (e.g., fluoride or chloride) and cationic species, in January 2001. The DOE will provide to the NRC an update to the *In-Drift Precipitates/Salts Analysis* AMR (ANL-EBS-MD-000045) that will provide additional technical bases for the low relative humidity model, expected to be available in FY 02.

NRC Review: NRC reviewed *In-Drift Precipitates/Salts Analysis* (ANL-EBS-MD-000045, Rev 00, ICN 02) and there are no comments regarding this version of the document. An improved precipitate/salts analysis is discussed in the Supplemental Science and Performance Analyses report, which recognizes the potential for deliquescence humidities much lower than the 50% assumed in the TSPA-SR due to  $MgCl_2$  and  $CaCl_2$  salts. The NRC staff believes this approach is acceptable and expects to see this new abstraction discussed, or the technical basis for not including the effects of mixed salts on lowering deliquescence humidities, in an update to the *In-Drift Precipitates/Salts Analysis* AMR which the DOE agreed to provide in FY02 per this agreement.

Additional Information Needed: None at this time.

Status of Agreement: Since DOE will provide an update to the AMR in FY02, ENFE Agreement 2.09 will continue to be listed as "Partly Received."

## **6) Evolution of the Near-Field Environment Agreement 2.16**

Wording of the Agreement: Provide the *Drift-Scale Coupled Processes (DST and THC Seepage) Models*, Rev. 01, including information supporting both the limited suite mineral model and the more complete extended model. The DOE will provide the *Drift-Scale Coupled Processes (DST and THC Seepage) Models* AMR (MDL-NBS-HS-000001) Rev 01, including information supporting both the limited suite mineral model and the more complete extended model, in March 2001.

NRC Review: The NRC reviewed *Drift-Scale Coupled Processes (DST and THC Seepage) Models* (MDL-NBS-HS-000001, Rev 01, ICN 00) as it pertains to this agreement. The NRC staff does not have any comments on this revision of the AMR. The NRC staff notes that an update to this AMR will be submitted in FY02 to support other ENFE agreements. The NRC staff will review this AMR again at that time and will address any issues within the other ENFE agreements.

Additional Information Needed: None at this time.

Status of Agreement: ENFE Agreement 2.16 is "Complete."

## **7) Evolution of the Near-Field Environment Agreement 2.18**

Wording of the Agreement: Provide the following documents: EBS: Physical and Chemical Environment Model, Rev. 01; Multiscale Thermohydrologic Model, Rev. 00, ICN 01; Abstraction of Drift-Scale Coupled Processes, Rev 01; Environments on the Surfaces of the Drip Shield and the Waste Package Outer Barrier, Rev. 00, ICN 01; Waste Package Degradation PMR, Rev. 00, ICN 01; EBS Degradation, Flow, and Transport PMR, Rev. 01; Near Field Environment PMR, Rev. 00, ICN 02 and Rev. 01; Hydrogen Induced Cracking of Drip Shield, Rev. 00, ICN 01; Drift Degradation Analysis, Rev. 01; Design Analysis for the Ex-Container Components, Rev. 00; Longevity of Emplacement Drift Ground Support Materials, Rev. 01; Stress Corrosion Cracking AMR, Rev. 00,



ICN 01; In-Drift Microbial Communities, Rev. 00, ICN 01; Physical and Chemical Environment Abstraction Model, Rev. 00, ICN 01; UZ Flow and Transport Model PMR, Rev. 01; General Corrosion and Localized Corrosion of the Drip Shield, Rev. 00; Water Distribution and Removal Model, Rev. 01. The DOE will provide the documents requested by the dates indicated: *Engineered Barrier System: Physical and Chemical Environment Model* (ANL-EBS-MD-000033) Rev. 01: FY 02; *Multiscale Thermohydrologic Model* (ANL-EBS-MD-000049) Rev. 00, ICN 01: January 2001; *Abstraction of Drift-Scale Coupled Processes* (ANL-NBS-HS-000029) Rev 01: September 2001; *Environment on the Surfaces of the Drip Shield and the Waste Package Outer Barrier* (ANL-EBS-MD-000001) Rev. 00, ICN 01: January 2001; *Waste Package Degradation PMR* (TDR-WIS-MD-000002) Rev. 00, ICN 01: January 2001; *Engineered Barrier System Degradation, Flow, and Transport PMR* (TDR-EBS-MD-000006) Rev. 01: September 2001; *Near Field Environment PMR* (TDR-NBS-MD-000001) Rev. 00, ICN 02: January 2001 and Rev. 01: September 2001; *Hydrogen Induced Cracking of Drip Shield* (ANL-EBS-MD-000006) Rev. 00, ICN 01: January 2001; *Drift Degradation Analysis* (ANL-EBS-MD-000027) Rev. 01: January 2001; *Design Analysis for the Ex-Container Components*, ANL-XCS-ME-000001 Rev. 00: January 2001; *Longevity of Emplacement Drift Ground Support Materials* (ANL-EBS-GE-000003) Rev. 01: January 2001; *Stress Corrosion Cracking of the Drip Shield, the Waste Package Outer Barrier, and the Stainless Steel Structural Material AMR* (ANL-EBS-MD-000005) Rev. 00, ICN 01: January 2001; *In-Drift Microbial Communities* (ANL-EBS-MD-000038) Rev. 00, ICN 01: January 2001; *Physical and Chemical Environmental Abstraction Model* (ANL-EBS-MD-000046) Rev. 00, ICN 01: January 2001; *Unsaturated Zone Flow and Transport Model PMR* (TDR-NBS-HS-000002) Rev. 01: September 2001; *General Corrosion and Localized Corrosion of the Drip Shield* (ANL-EBS-MD-000004) Rev. 00: January 2001; *Water Distribution and Removal Model* (ANL-EBS-MD-000032) Rev. 01: January 2001.

NRC Review: DOE provided, and NRC reviewed the following documents as they pertain to this agreement:

- 1) Multiscale Thermohydrologic Model (ANL-EBS-MD-000049, Rev 00, ICN 01)
- 2) Environment on the Surfaces of the Drip Shield and the Waste Package Outer Barrier (ANL-EBS-MD-000001, Rev 00, ICN 01)
- 3) Waste Package Degradation PMR (TDR-WIS-MD-000002, Rev 00, ICN 01)
- 4) Near Field Environment PMR (TDR-NBS-MD-000001, Rev 00, ICN 03)
- 5) Hydrogen Induced Cracking of Drip Shield (ANL-EBS-MD-000006, Rev 00, ICN 01)
- 6) Drift Degradation Analysis (ANL-EBS-MD-000027, Rev 01, ICN 00)
- 7) Design Analysis for the Ex-Container Components (ANL-XCS-ME-000001, Rev 00, ICN 00)
- 8) Longevity of Emplacement Drift Ground Support Materials (ANL-EBS-GE-000003, Rev 01, ICN 00)
- 9) Stress Corrosion Cracking of the Drip Shield, the Waste Package Outer Barrier, and the Stainless Steel Structural Material (ANL-EBS-MD-000005, Rev 00, ICN 01)
- 10) In-Drift Microbial Communities (ANL-EBS-MD-000038, Rev 00, ICN 01)
- 11) Physical and Chemical Environmental Abstraction Model (ANL-EBS-MD-000046, Rev 00, ICN 01)
- 12) General Corrosion and Localized Corrosion of the Drip Shield (ANL-EBS-MD-000004, Rev 00, ICN 00)
- 13) Water Distribution and Removal Model (ANL-EBS-MD-000032, Rev 01, ICN 00)

The NRC staff notes that DOE provided Abstraction of Models for Stress Corrosion Cracking of Drip Shield and Waste Package Outer Barrier and Hydrogen Induced Corrosion of Drip Shield (ANL-EBS-PA-000004, Rev 00, ICN 01). Since this agreement did not specifically call for this

AMR, the NRC staff did not review the document for this agreement. If the NRC staff's review of this document raises any questions or concern, the staff will formally document its questions in a letter to DOE.

The NRC staff has no comments at this time. The NRC staff will review the other documents pertaining to this agreement when they become available. The staff will continue to review information regarding the evolution of the near-field environment due to interactions with ground support materials in other DOE AMRs.

Additional Information Needed: None at this time.

Status of Agreement: Since additional DOE documents need to be provided for this agreement, ENFE Agreement 2.18 will continue to be listed as "Partly Received."

### **8) Evolution of the Near-Field Environment Agreement 3.01**

Wording of the Agreement: Provide the following documents: WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR, Rev. 00, ICN 01; Near-Field Environment PMR, Rev. 00, ICN 03; In-Package Chemistry AMR, Rev. 01; CAL-EBS-PA-000002, Rev. 01; ANL-EBS-PA-000005, Rev. 00; In-Package Chemistry Abstraction AMR, Rev. 01; TSPA-SR, Rev. 00; Waste Form Colloid-Associated Concentration Limits: Abstraction and Summary AMR. The DOE will provide the following documents to the NRC by February 2001: *WAPDEG Analysis of Waste Package and Drip Shield Degradation* AMR (ANL-EBS-PA-000001) Rev 00 ICN 01; *Near Field Environment* PMR (TDR-NBS-MD-000001) Rev 00 ICN 03; *Summary of In-Package Chemistry for Waste Forms* AMR (ANL-EBS-MD-000050) Rev 01; *Calculation of General Corrosion Rate of Drip Shield and Waste Package Outer Barrier to Support WAPDEG Analysis* (CAL-EBS-PA-000002) Rev 01; *Abstraction of Models for Stainless Steel Structural Material Degradation* (ANL-EBS-PA-000005) Rev 00; *In-Package Chemistry Abstraction* AMR (ANL-EBS-MD-000037) Rev 01; *Total System Performance Assessment for the Site Recommendation* (TDR-WIS-PA-000001) Rev 00; *Waste Form Colloid-Associated Concentrations Limits: Abstraction and Summary* AMR (ANL-WIS-MD-000012) Rev 00 ICN 01.

NRC Review: DOE provided, and NRC reviewed the following documents as they pertain to this agreement:

- 1) WAPDEG Analysis of Waste Package and Drip Shield Degradation (ANL-EBS-PA-000001, Rev 00, ICN 01)
- 2) Near Field Environment PMR (TDR-NBS-MD-000001, Rev 00 ICN 03)
- 3) In-Package Chemistry for Waste Forms (ANL-EBS-MD-000056, Rev 00, ICN 00)
- 4) Calculation of General Corrosion Rate of Drip Shield and Waste Package Outer Barrier to Support WAPDEG Analysis (CAL-EBS-PA-000002, Rev 01, ICN 00)
- 5) Abstraction of Models for Stainless Steel Structural Material Degradation (ANL-EBS-PA-000005, Rev 00, ICN 00)
- 6) In-Package Chemistry Abstraction (ANL-EBS-MD-000037, Rev 01, ICN 00)
- 7) Total System Performance Assessment for the Site Recommendation (TDR-WIS-PA-000001, Rev 00, ICN 01)
- 8) Waste Form Colloid-Associated Concentrations Limits: Abstraction and Summary (ANL-WIS-MD-000012, Rev 00 ICN 01)

Regarding documents 1, 2, 4, 5, 7, and 8, the NRC staff has reviewed the documents and has no comments at this time.

Regarding documents 3 and 6, the NRC staff has reviewed these documents and comments were provided to the DOE during the TSPA technical exchange discussions on model abstraction. There are no further comments on these documents pertaining to this agreement. Under TSPA Agreement 3.14, the DOE agreed to account for the full range of environmental conditions for the in-package chemistry model. DOE will update the in-package chemistry model to account for scenarios and their associated uncertainties required by TSPA. This will be documented in the revised In-Package Chemistry AMR (ANL-EBS-MD-000056) expected to be available to NRC in FY 2003.

Additional Information Needed: None at this time.

Status of Agreement: ENFE Agreement 3.01 is "Complete."

## **9) Evolution of the Near-Field Environment Agreement 3.05**

Wording of the Agreement: Provide the technical basis for selection of radionuclides that are released via reversible and irreversible attachment to colloids for different waste forms in the TSPA. The technical bases for the selection of radionuclides released via reversible and irreversible attachments to colloids for different waste forms is provided in section 3.5.6.1 of the *Total System Performance Assessment (TSPA) Model for Site Recommendation* (MDL-WIS-PA-000002) Rev 00. This document will be provided to the NRC in January 2001.

NRC Review: NRC reviewed the Total System Performance Assessment Model for Site Recommendation (MDL-WIS-PA-000002, Rev 00, ICN 00) and the technical basis for selecting radionuclides for release modeling via reversible and irreversible colloidal attachment is not transparent and traceable in all cases. The agreement states that this issue is addressed in Section 3.5.6.1 of the document, however, the relevant section is actually in Total System Performance Assessment for the Site Recommendation (TDR-WIS-PA-000001, Rev 00 ICN 01). This qualitative discussion does not address the possibility that waste form colloids (irreversible attachment) could significantly transport radioelements other than plutonium and americium, despite observations of other elements such as uranium and thorium irreversibly attached on colloids in waste corrosion tests (see Colloid-Associated Radionuclide Concentration Limits - ANL-EBS-MD-000020, Rev 00). In addition, the argument neglects the potential contribution to release of reversible colloid attachment of less sorbing radioelements such as neptunium and uranium. It is not clear if analyses have been conducted showing that the effect of colloidal attachment on release of these other radionuclides is insignificant. For example, it may be possible that release of moderately sorbing radioelements would be significantly enhanced by reversible sorption onto colloids. These issues are also not adequately addressed in the AMR Colloid-Associated Concentration Limits: Abstraction and Summary (ANL-WIS-MD-000012, Rev 00).

The technical basis for the exclusion of irreversible radionuclide attachment onto spent nuclear fuel colloids is not adequate. It is noted in ANL-WIS-MD-000012, Rev 00, that the lack of observed attachment of this type may be an effect of the spent nuclear fuel test configuration, and that "fewer data were obtained from the CSNF testing than from the HLW glass testing." In addition, ANL-WIS-MD-000012, Rev 00, discusses the possibility that a plutonium-rich alteration layer on

corroded spent nuclear fuel may be released by spallation, though this has not yet been observed. Also, as discussed in the ENFE IRSR, Rev 3 (U.S. Nuclear Regulatory Commission, 2000; page 224), other DOE reports contain evidence for irreversible plutonium attachment to corrosion product colloids. For other waste types such as DOE-spent nuclear fuel, DOE needs to either screen out colloid-associated radionuclide release or develop modeling approaches for them. In ANL-WIS-MD-000012, Rev 00, N-Reactor fuel is specifically discussed as requiring an assessment of importance to performance and possible inclusion in abstraction.

Recently, the Technical Update Impact Letter Report (MIS-MGR-RL-000001 REV 00) described new laboratory analyses relevant to colloidal release from spent nuclear fuel by irreversible attachment. The new interpretations are tentative and the discussion states that analyses will continue. Therefore, this new information is not sufficient to close the agreement.

According to the TSPA/SR model report, only release of plutonium, americium, thorium, and protactinium are modeled as colloidal, but other radioelements are included in unsaturated and saturated zone transport models. This apparent lack of model integration may be justified, but should be clarified. In addition, there still exists confusion among the various reports cited in this section about the disposition of specific radioelements in colloid modeling (this issue will also be addressed in the NRC's review of Radionuclide Transport Agreement 1.03).

Additional Information Needed:

- 1) Provide clarification and justification of radionuclides for which reversible and irreversible colloidal release is modeled.
- 2) Provide a stronger technical basis that release by irreversible attachment can be neglected for spent nuclear fuel.

Status of Agreement: ENFE Agreement 3.05 requires additional information to support a potential licensing review.

#### **10) Evolution of the Near-Field Environment Agreement 4.01**

Wording of the Agreement: Provide the executable version of the most recently qualified version of TOUGHREACT. The DOE will provide the executable TOUGHREACT Rev 2.2 to the NRC by February 2001, subject to the NRC obtaining any applicable agreement for usage of the software.

NRC Review: DOE provided the TOUGHREACT code in a letter dated September 28, 2001, therefore, this agreement is complete.

Additional Information Needed: None at this time.

Status of Agreement: ENFE Agreement 4.01 is "Complete."

#### **11) Evolution of the Near-Field Environment Agreement 4.02**

Wording of the Agreement: Provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR, Rev. 01 and 02. The DOE will provide the *Drift-Scale Coupled Processes (DST and THC Seepage) Models* AMR (MDL-NBS-HS-000001) Rev 01 to the NRC in March 2001. The DOE

will provide the *Drift-Scale Coupled Processes (DST and THC Seepage) Models* AMR Rev 02 to the NRC in FY 02.

NRC Review: The NRC reviewed *Drift-Scale Coupled Processes (DST and THC Seepage) Models* (MDL-NBS-HS-000001, Rev 01, ICN 00) as it pertains to this agreement. The NRC staff does not have any comments on Revision 01 of this document and will review Revision 02 when it is submitted in FY02.

Additional Information Needed: None at this time.

Status of Agreement: Since DOE still needs to submit Revision 02 of the document, ENFE Agreement 4.02 will continue to be listed as "Partly Received."

## **12) Evolution of the Near-Field Environment Agreement 4.05**

Wording of the Agreement: Provide the screening criteria for the radionuclides selected for PA. Provide the technical basis for selection of radionuclides that are transported via colloids in the TSPA. The screening criteria for radionuclides selected for TSPA are contained in the AMR *Inventory Abstraction* (ANL-WIS-MD-000006) Rev 00, ICN 01. The DOE is documenting identification of radionuclides transported via colloids for TSPA in the AMR *Colloid-Associated Concentration Limits: Abstraction and Summary* (ANL-WIS-MD-000012) Rev 0, in the Total System Performance Assessment for the Site Recommendation (TDR-WIS-PA-000001) Rev 00 ICN 01, and in the *Total System Performance Assessment (TSPA) Model for Site Recommendation* (MDL-WIS-PA-000002) Rev 00. These documents will be available to the NRC in January 2001.

NRC Review: See also Item 9 of this letter for more detail. The arguments in the TSPA-SR reports (TDR-WIS-PA-000001 Rev 00 ICN 01; MDL-WIS-PA-000002, Rev 00) and the colloid release abstraction AMR (ANL-WIS-MD-000012 Rev 00) do not fully address the NRC comments, and should be strengthened to better support the neglect of (i) irreversible attachment of radioelements other than plutonium and americium and (ii) reversible attachment of radioelements other than plutonium, americium, thorium, and protactinium. The arguments could rely, for example, on sensitivity analyses.

This agreement is also related to RT Agreement 1.03.

Additional Information Needed:

1) Provide clarification and justification of radionuclides for which reversible and irreversible colloidal release is modeled.

Status of Agreement: ENFE Agreement 4.05 requires additional information to support a potential licensing review.

## **13) Evolution of the Near-Field Environment Agreement 4.06**

Wording of the Agreement: Provide documentation to demonstrate suitability of the bounding values used for colloid transport through the perturbed near-field environment. For example,

consider sensitivity analyses to investigate the effects of varying colloid sorption parameters ( $K_c$ ) on repository performance. The DOE will evaluate the suitability of the colloid transport model under perturbed conditions as discussed in agreement #3 for this subissue. As part of this work, the DOE will consider sensitivity analyses to investigate the effects of varying colloid sorption parameters ( $K_c$ ) on repository performance. The DOE will also provide the TSPA-SR (TDR-WIS-PA-000001) Rev 00 ICN 01 in January 2001. The TSPA-SR includes sensitivity studies in the form of barrier degradation and parameter sensitivity analyses that investigate the effect of sorption and colloid parameters on repository performance.

NRC Review: The NRC reviewed TSPA for Site Recommendation (TDR-WIS-PA-000001, Rev 00, ICN 01) and the report included sensitivity analyses of the effect of colloid parameters on repository performance. However, these analyses did not include values for parameters outside the adopted uncertainty range and do not provide sufficient assurance that data uncertainty has been bounded. Future sensitivity studies should address the substantial uncertainties regarding colloidal behavior during waste corrosion and radionuclide release.

Additional Information Needed:

1) Provide additional sensitivity analyses of colloid release and transport parameters as discussed in the agreement. Related issues are covered under TSPA-I Agreements 3.17, 3.30, and 3.42.

Status of Agreement: Since DOE: (1) will evaluate the suitability of the colloid transport model under perturbed conditions under ENFE Agreement 4.03 and include, as part of this work, consideration of sensitivity analyses to investigate the effects of varying colloid sorption parameters on repository performance, and (2) has not provided information to ENFE Agreement 4.03 to date, the NRC will continue to list ENFE Agreement 4.06 as "Partly Received." When DOE responds to ENFE Agreement 4.03, the NRC staff will evaluate both agreements together.